# RJH60D7DPQ-E0

600V - 50A - IGBT
Application: Inverter

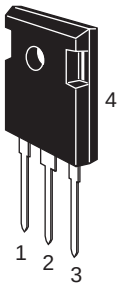
R07DS0740EJ0100
Rev.1.00
Apr 19, 2012

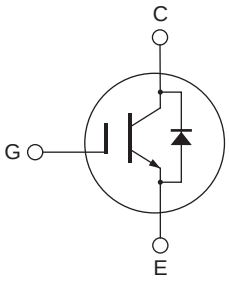
## Features

- Short circuit withstand time (5 μs typ.)
- Low collector to emitter saturation voltage
  $V_{CE(sat)}$ = 1.6 V typ. (at $I_C$ = 50 A, $V_{GE}$ = 15 V, Ta = 25°C)
- Built in fast recovery diode (100 ns typ.) in one package
- Trench gate and thin wafer technology
- High speed switching
  $t_f$ = 50 ns typ. (at $V_{CC}$ = 300 V, $V_{GE}$ = 15 V, $I_C$ = 50 A, Rg = 5 Ω, Ta = 25°C, inductive load)

## Outline

RENESAS Package code: PRSS0003ZE-A
(Package name: TO-247)




1. Gate
2. Collector
3. Emitter
4. Collector

## Absolute Maximum Ratings

(Ta = 25°C)

| Item | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Collector to emitter voltage / diode reverse voltage | | $V_{CES}$ / $V_R$ | 600 | V |
| Gate to emitter voltage | | $V_{GES}$ | ±30 | V |
| Collector current | Tc = 25°C | $I_C$ | 90 | A |
| | Tc = 100°C | $I_C$ | 50 | A |
| Collector peak current | | ic(peak) Note1 | 200 | A |
| Collector to emitter diode forward current | | $i_{DF}$ | 50 | A |
| Collector to emitter diode forward peak current | | $i_{DF}$(peak) Note1 | 200 | A |
| Collector dissipation | | $P_C$ Note2 | 300 | W |
| Junction to case thermal resistance (IGBT) | | θj-c Note2 | 0.42 | °C/ W |
| Junction to case thermal resistance (Diode) | | θj-cd Note2 | 1.07 | °C/ W |
| Junction temperature | | Tj | 150 | °C |
| Storage temperature | | Tstg | –55 to +150 | °C |

Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%
2. Value at Tc = 25°C

## Electrical Characteristics

(Ta = 25°C)

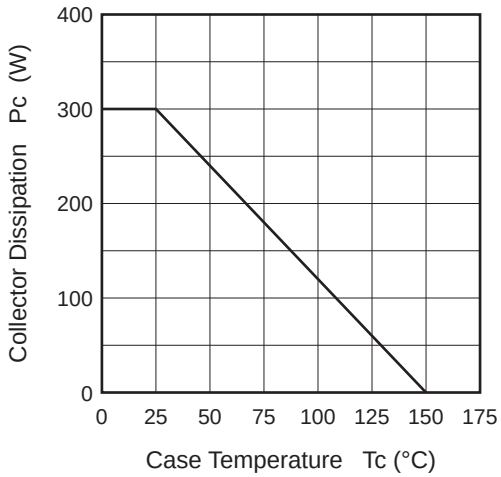
| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Collector to emitter breakdown voltage | $V_{BR(CES)}$ | 600 | — | — | V | $I_C$ =10 μA, $V_{GE}$ = 0 |
| Zero gate voltage collector current / Diode reverse current | $I_{CES}$ / $I_R$ | — | — | 5 | μA | $V_{CE}$ = 600 V, $V_{GE}$ = 0 |
| Gate to emitter leak current | $I_{GES}$ | — | — | ±1 | μA | $V_{GE}$ = ±30 V, $V_{CE}$ = 0 |
| Gate to emitter cutoff voltage | $V_{GE(off)}$ | 4.0 | — | 6.0 | V | $V_{CE}$ = 10 V, $I_C$ = 1 mA |
| Collector to emitter saturation voltage | $V_{CE(sat)}$ | — | 1.6 | 2.2 | V | $I_C$ = 50 A, $V_{GE}$ = 15 V Note3 |
| | $V_{CE(sat)}$ | — | 1.8 | — | V | $I_C$ = 90 A, $V_{GE}$ = 15 V Note3 |
| Input capacitance | Cies | — | 3000 | — | pF | $V_{CE}$ = 25 V<br>$V_{GE}$ = 0<br>f = 1 MHz |
| Output capacitance | Coes | — | 160 | — | pF | |
| Reveres transfer capacitance | Cres | — | 85 | — | pF | |
| Total gate charge | Qg | — | 130 | — | nC | $V_{GE}$ = 15 V<br>$V_{CE}$ = 300 V<br>$I_C$ = 50 A |
| Gate to emitter charge | Qge | — | 20 | — | nC | |
| Gate to collector charge | Qgc | — | 45 | — | nC | |
| Turn-on delay time | $t_{d(on)}$ | — | 60 | — | ns | $V_{CC}$ = 300 V<br>$V_{GE}$ = 15 V<br>$I_C$ = 50 A<br>Rg = 5 Ω<br>(Inductive load) |
| Rise time | $t_r$ | — | 46 | — | ns | |
| Turn-off delay time | $t_{d(off)}$ | — | 190 | — | ns | |
| Fall time | $t_f$ | — | 50 | — | ns | |
| Turn-on energy | $E_{on}$ | — | 1.1 | — | mJ | |
| Turn-off energy | $E_{off}$ | — | 0.6 | — | mJ | |
| Total switching energy | $E_{total}$ | — | 1.7 | — | mJ | |
| Short circuit withstand time | $t_{sc}$ | 3.0 | 5.0 | — | μs | $V_{CC}$ ≤ 360 V, $V_{GE}$ = 15 V |

| | | | | | | |
|---|---|---|---|---|---|---|
| FRD forward voltage | $V_F$ | — | 1.4 | 2.0 | V | $I_F$ = 50 A Note3 |
| FRD reverse recovery time | $t_{rr}$ | — | 100 | — | ns | $I_F$ = 50 A<br>$di_F/dt$ = 100 A/μs |
| FRD reverse recovery charge | $Q_{rr}$ | — | 0.4 | — | μC | |
| FRD peak reverse recovery current | $I_{rr}$ | — | 6.5 | — | A | |

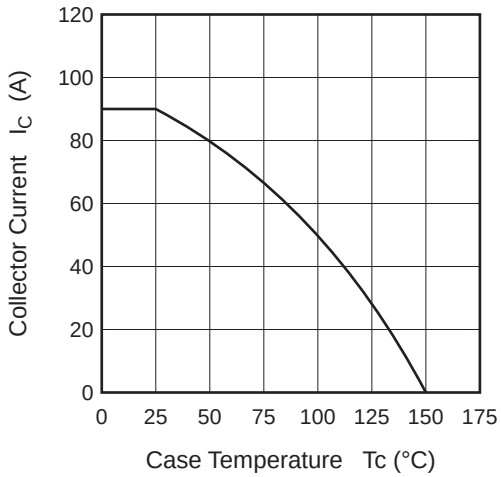
Notes: 3. Pulse test

## Main Characteristics

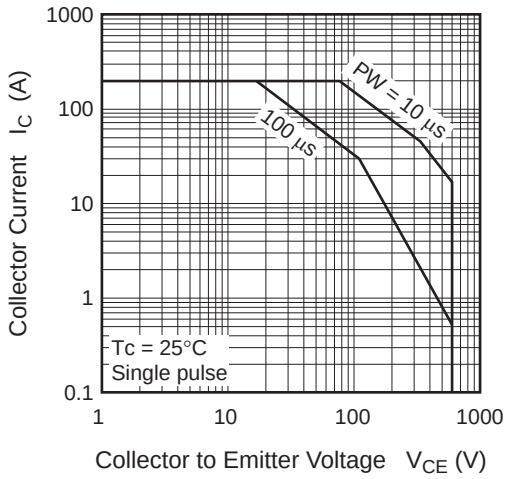
Collector Dissipation vs. Case Temperature



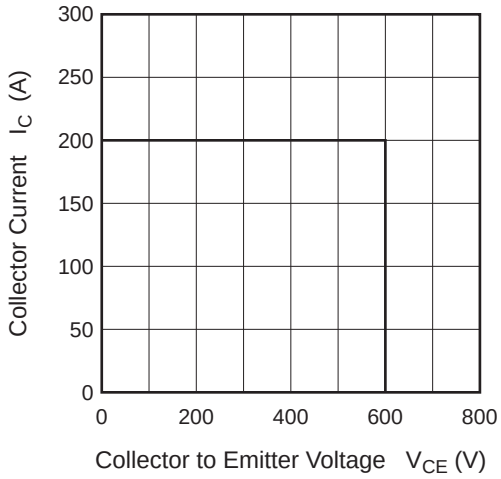

Maximum DC Collector Current vs. Case Temperature



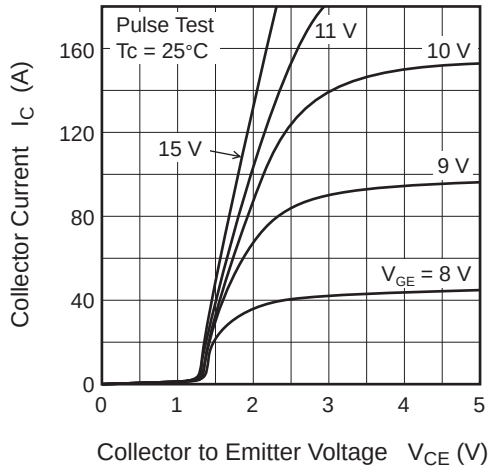

Maximum Safe Operation Area



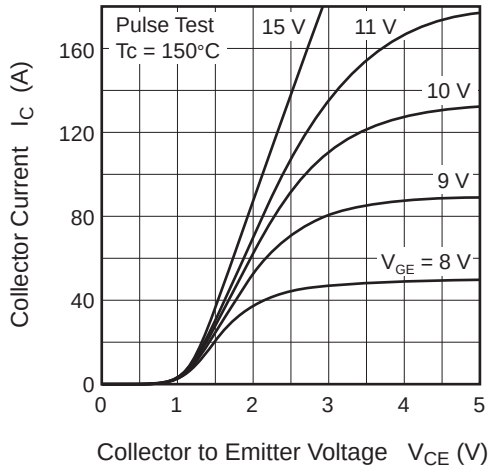

Turn-off SOA



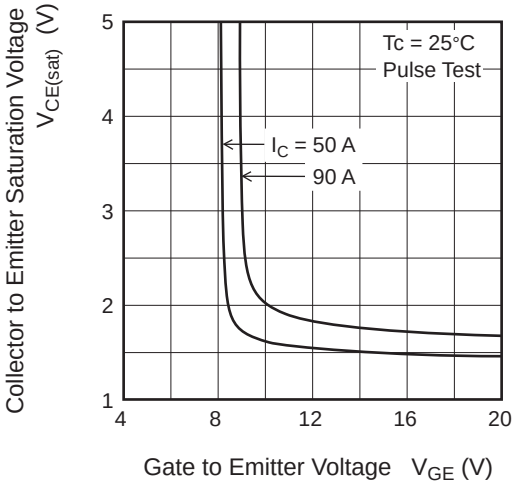

Typical Output Characteristics



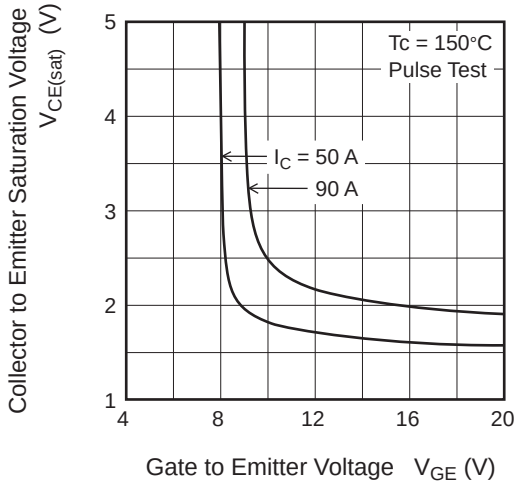

Typical Output Characteristics



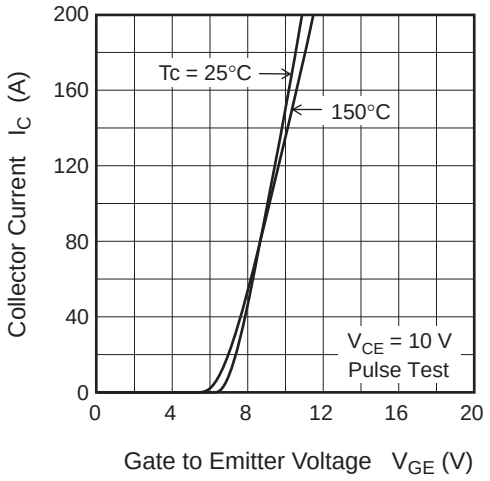
Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage (Typical)



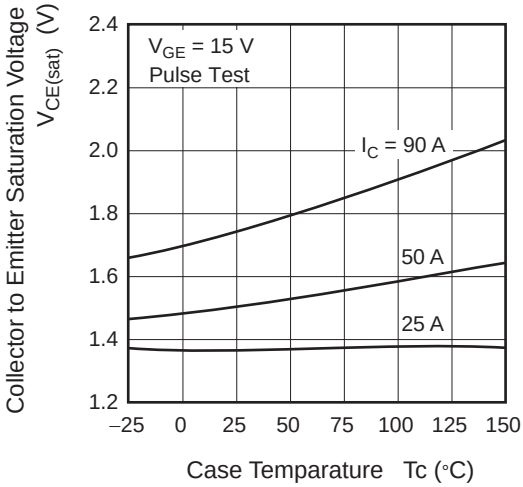

Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage (Typical)



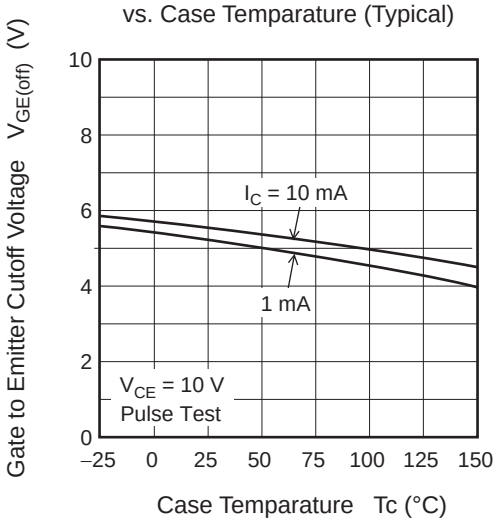

Typical Transfer Characteristics



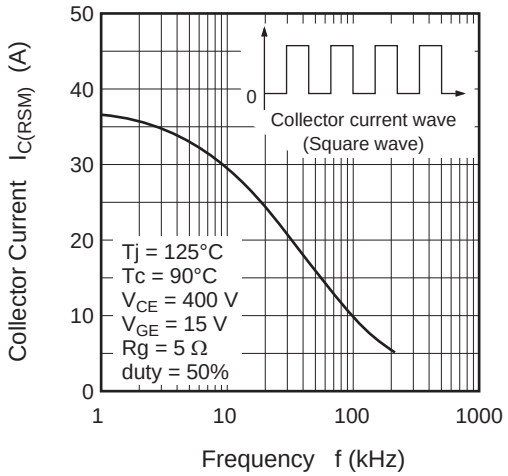

Collector to Emitter Saturation Voltage vs. Case Temparature (Typical)



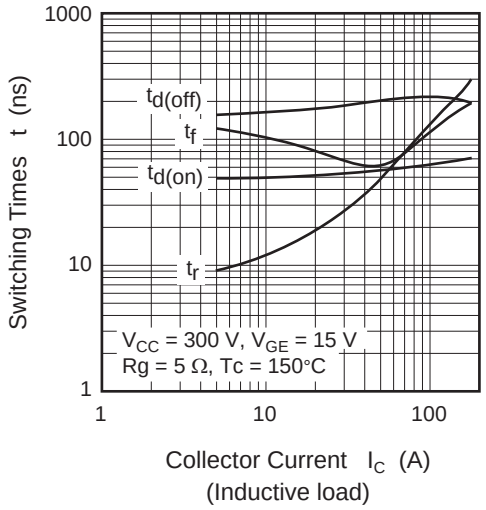

Gate to Emitter Cutoff Voltage vs. Case Temparature (Typical)



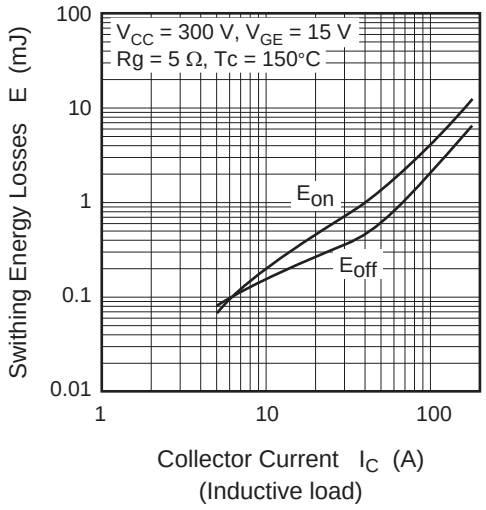

Frequency Characteristics (Typical)



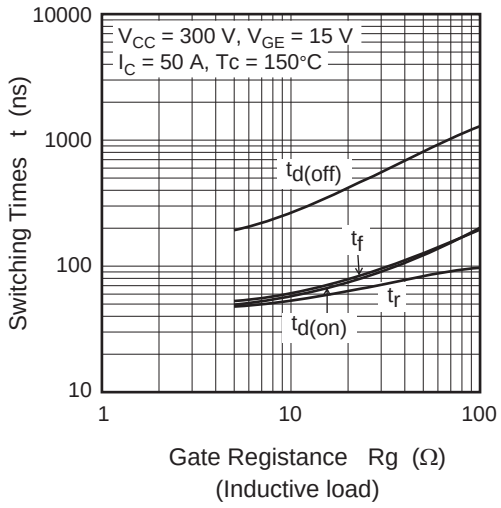
Switching Characteristics (Typical) (1)



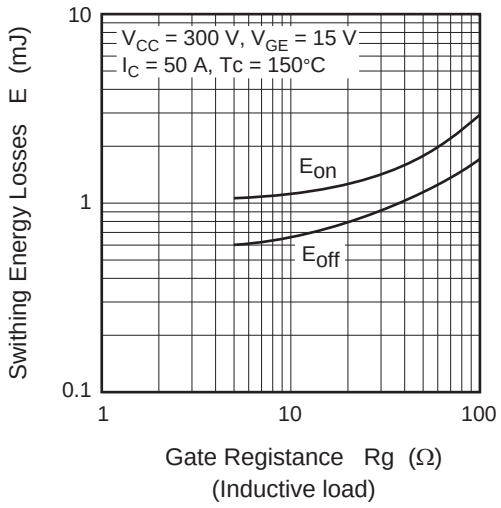

Switching Characteristics (Typical) (2)



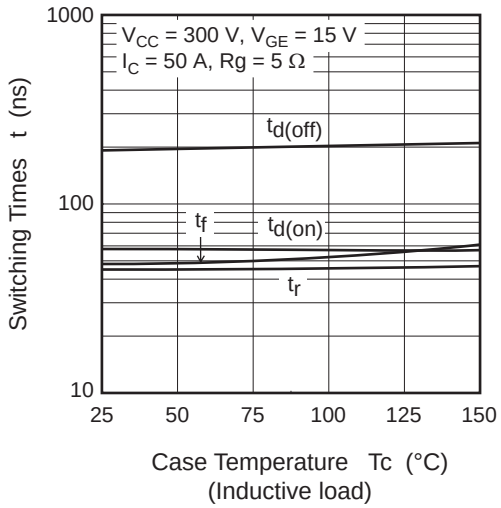

Switching Characteristics (Typical) (3)



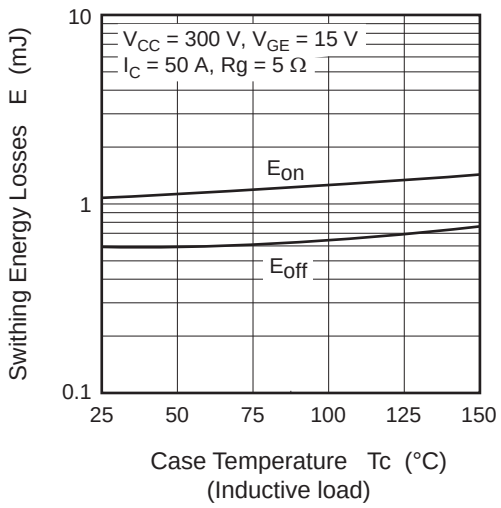

Switching Characteristics (Typical) (4)



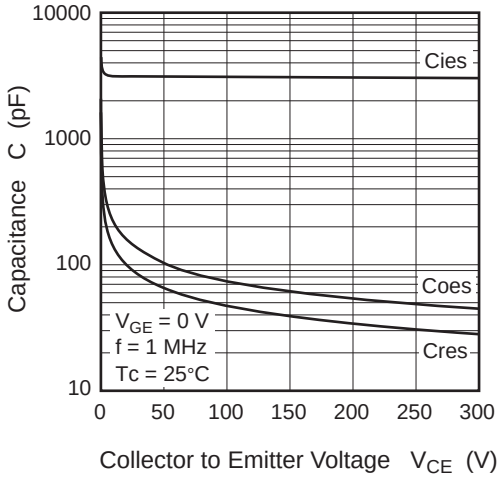

Switching Characteristics (Typical) (5)



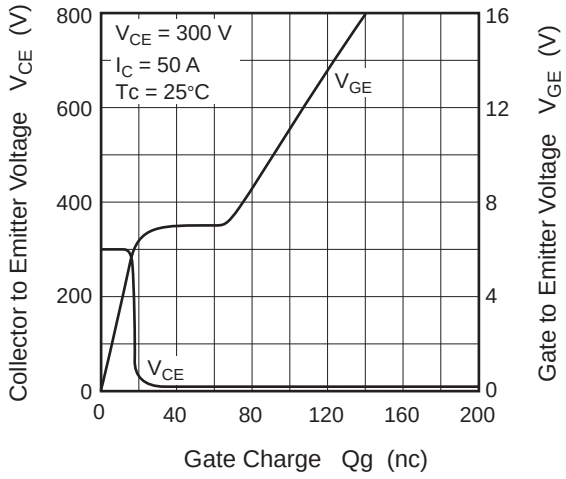

Switching Characteristics (Typical) (6)



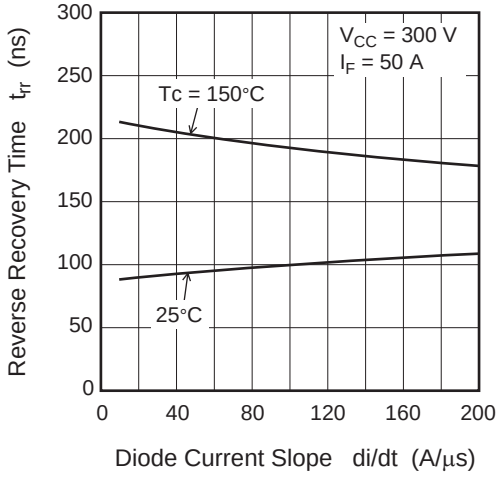
Typical Capacitance vs.
Collector to Emitter Voltage



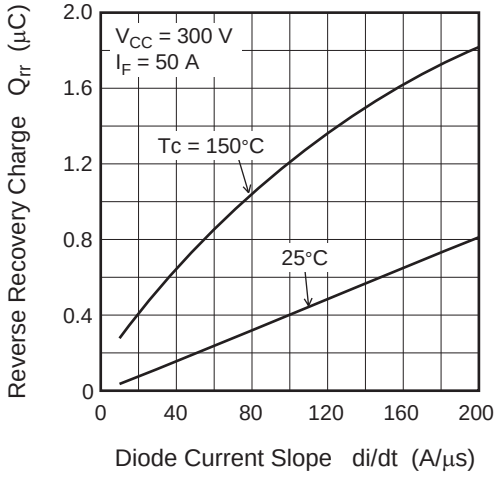

Dynamic Input Characteristics (Typical)



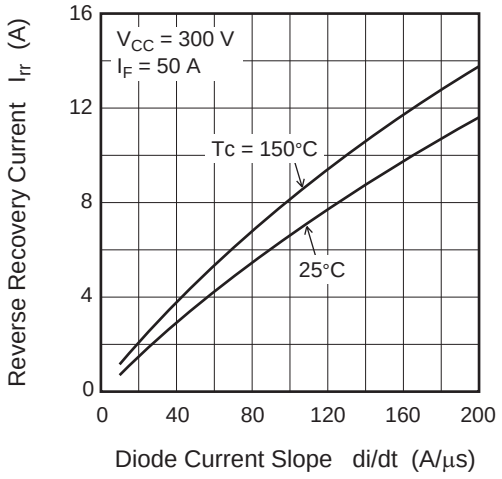

Reverse Recovery Time vs.
Diode Current Slope (Typical)



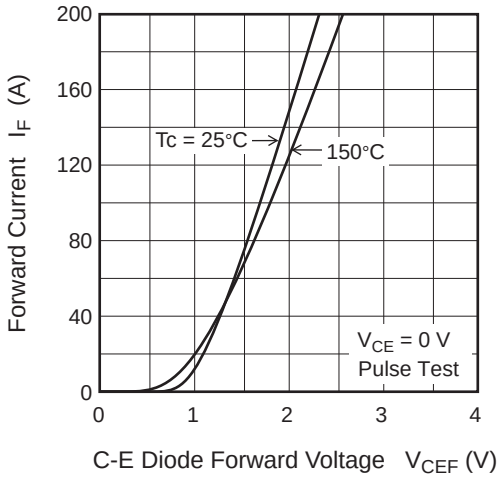

Reverse Recovery Charge vs.
Diode Current Slope (Typical)

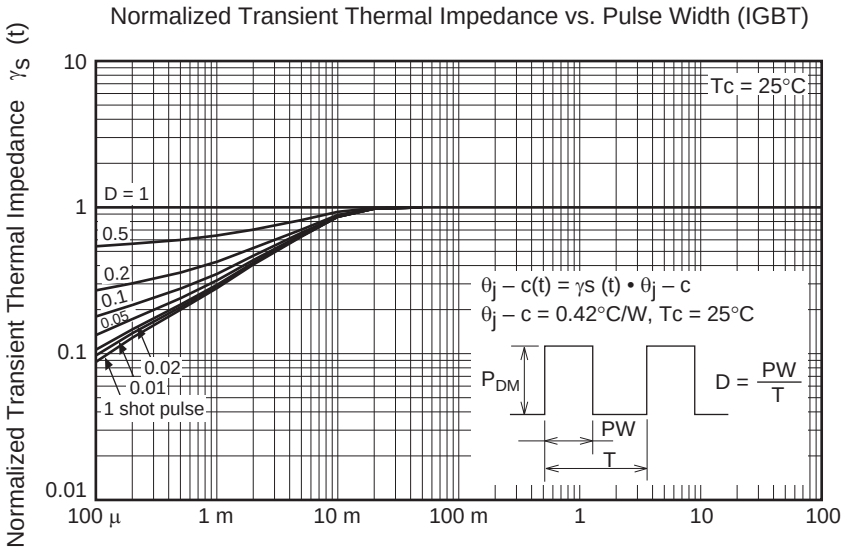


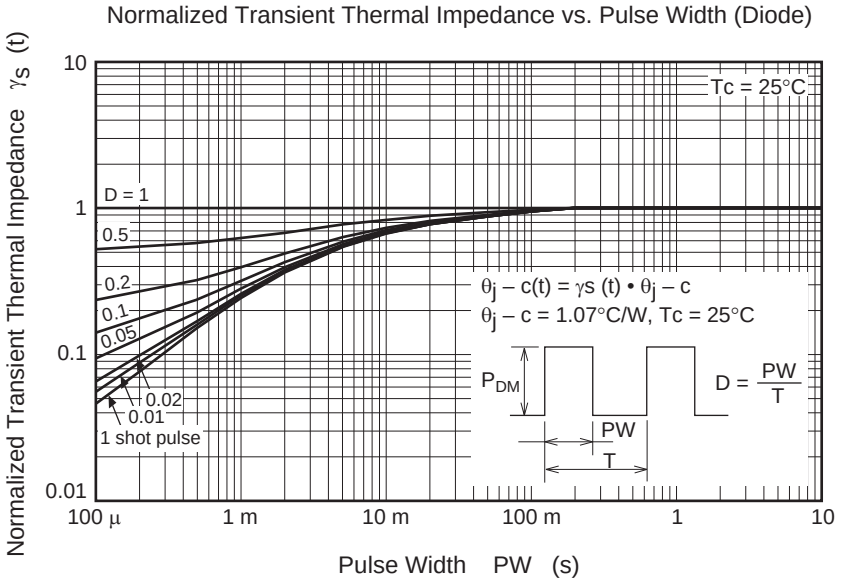

Reverse Recovery Current vs.
Diode Current Slope (Typical)



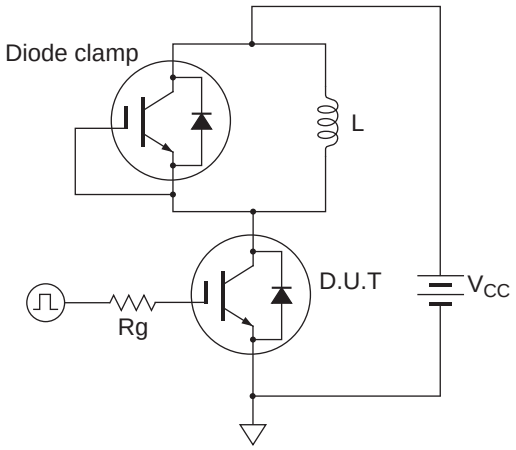

Forward Current vs. Forward Voltage (Typical)



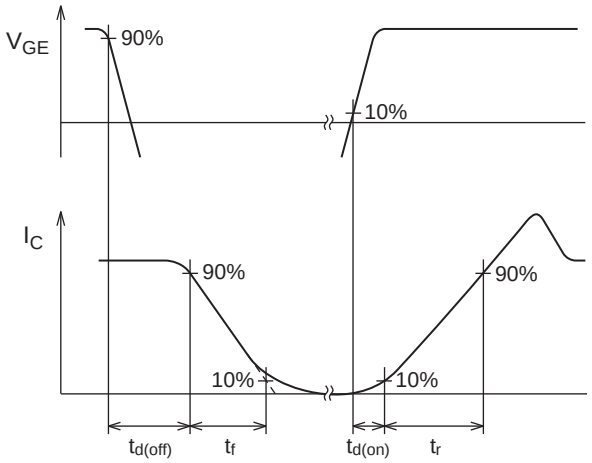

Normalized Transient Thermal Impedance vs. Pulse Width (IGBT)
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1 shot pulse
θj – c(t) = γs (t) • θj – c
θj – c = 0.42°C/W, Tc = 25°C
PDM
D = PW / T
PW
T
100 μ
1 m
10 m
100 m
1
10
100


Normalized Transient Thermal Impedance vs. Pulse Width (Diode)
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1 shot pulse
θj – c(t) = γs (t) • θj – c
θj – c = 1.07°C/W, Tc = 25°C
PDM
D = PW / T
PW
T
100 μ
1 m
10 m
100 m
1
10
Pulse Width PW (s)

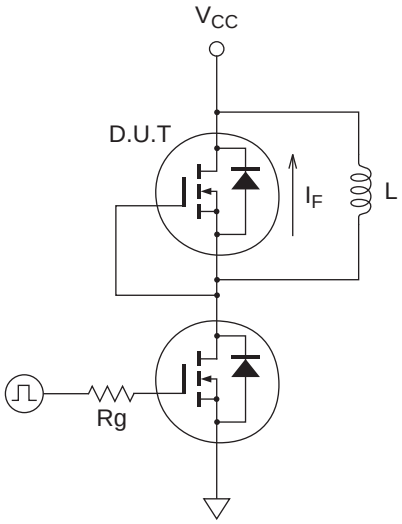
Switching Time Test Circuit



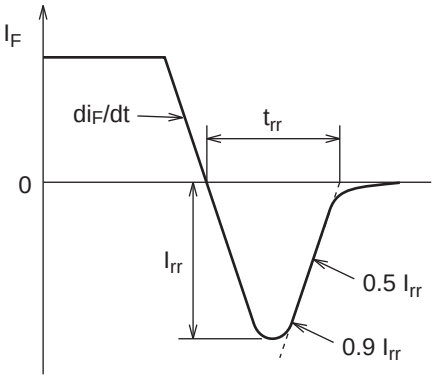

Waveform




Diode Reverse Recovery Time Test Circuit



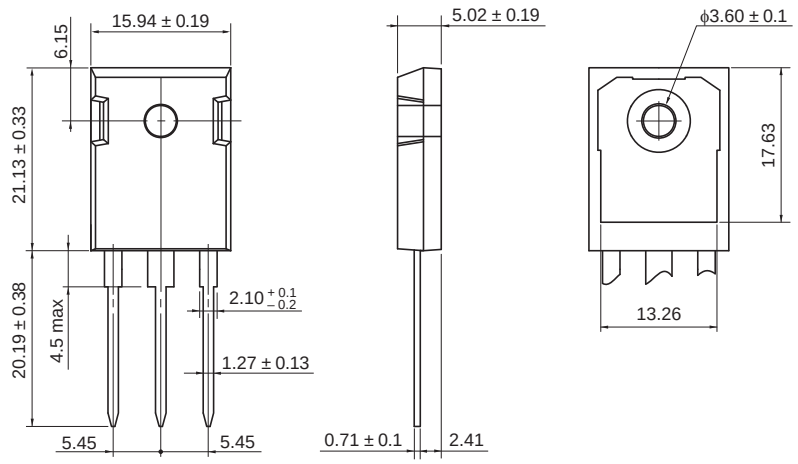

Waveform



## Package Dimension

| Package Name | JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|---|
| TO-247 | — | PRSS0003ZE-A | — | 6.0g |

Unit: mm




## Ordering Information

| Orderable Part No. | Quantity | Shipping Container |
|---|---|---|
| RJH60D7DPQ-E0#T2 | 240 pcs | Box (Tube) |

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